

# Syllabus Astronomy 111/112

Fall 2022

*Astronomy 111/112 is an active learning version of the general education astronomy course on the solar system. This course fulfills the requirement for a 4 credit natural science lab course.*

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### **Contact Information:**

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### **General Student Learning Outcomes:**

Astronomy 111/112 is part of the core natural science program. According to the GMU catalogue the purpose of general education courses is: “to educate, liberate, and broaden the mind, and to instill a lifelong love of learning.” Core natural science courses engage students in scientific exploration, foster their curiosity, enhance their enthusiasm for science, and enable them to apply scientific knowledge and reasoning to personal, professional and public decision-making.

At the end of the semester, students should be able to:

1. *Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge evolves based on new evidence and differs from personal and cultural beliefs.*
2. *Recognize the scope and limits of science.*
3. *Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, natural disasters, etc.).*
4. *Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).*
5. *Participate in scientific inquiry and communicate the elements of the process (for lab courses only) by: a) Making careful and systematic observations, b) Developing and testing a hypothesis, c) Analyzing evidence, d) Interpreting results.*

### **Course Objectives for Astronomy 111/112:**

Astronomy 111/112 is a core natural science course (lecture and lab combined) focused on the *solar system*. It is designed to help students understand the scientific process and to develop their scientific reasoning skills in the context of astronomy. *The main emphasis of the course is investigating how astronomers have come to know what they know about the solar system based on the light that reaches us.*

### **Course Structure and Philosophy:**

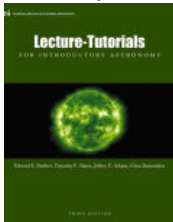
The course has a “flipped” structure: *outside the class, students are expected to read the material, watch short videos, and do a homework quiz with weekly deadlines on Sunday. On Tuesdays*, students will be involved in several collaborative activities such as lecture tutorials, mini-investigations, whereas *Thursdays* will be dedicated mostly to the labs. Most of the time you will *work in small groups* (made of 2 or 3 members) randomly assigned. Working with others can be an effective way to learn, and importantly most jobs require some level of collaborative work. New tables are randomly assigned every four weeks.

To succeed it is important to *dedicate adequate time and effort outside the class* to study the basic concepts, which are further mastered through class activities. The level of engagement and commitment required for this class is greater than for a standard lecture; as with all things worth doing, it will require effort, attendance, and commitment.

### **Text Books (required):**

1) *OpenStax Astronomy (open educational resource available for free as a pdf)*  
(<https://openstax.org/details/books/astronomy>)

2) *Lecture-Tutorials for Introductory Astronomy* (3<sup>th</sup> Edition).  
Prather, Slater, Adams & Brissenden.



### **Blackboard & Technology requirements:**

You will need a *reliable laptop or tablet (please, do not use your phone)* to participate in the class activities and complete your homework (the course’s material is delivered through Blackboard). You must be able to both upload and download documents.

You will need to *check your emails (use the GMU account) often and Blackboard at least weekly*. For issues with Blackboard contact [courses@gmu.edu](mailto:courses@gmu.edu), and the ITU Support Center (703 993-8870) for general help with information about technology.

### ***Work Ethic & Policies:***

Active learning courses require more participation and input by students than do traditional large lecture format courses. Astronomy 111/112 involves both individual and collaborative work. You are expected to contribute actively to group activities and to respect and value opinions and work of other group members.

You will need to participate fully each week by:

- 1) coming on time and prepared to class and completing the collaborative and individual class activities;
- 2) completing the at-home individual activities (one weekly quiz).

**There are three mandatory tests:** two midterms and one comprehensive final. All tests will be taken in the COS Testing Center (located in Planetary Hall room 2, in the basement).

### ***Supplies:***

Each student needs the following supplies for each face-to-face meeting:

- Laptop/tablet
- Notebook or loose leaf of paper with pencils/pens
- Lecture tutorial book

### ***Students with disabilities:***

Students with documented disabilities or special should contact the instructor during the first week of class. Students who suspect they have disabilities that need accommodation should contact the Office of Disability Services at George Mason as soon as possible in order to get proper documentation.

### ***Student resources:***

[Academic advising center](#) – 703-993-2470

[Campus counseling center](#) – 703-993-2380

[Office of Disability Services](#) – 703-993-2474

[Writing center](#) – 703-993-1200

[Math tutoring center](#) – 703-993-1460

[Office of Diversity, Inclusion, and Multicultural Education](#)

[Religious Holiday Calendar](#)

### ***Honor Code:***

George Mason's Honor code states that "Student members of the George Mason University pledge not to cheat, plagiarize, steal, or lie in matters related to academic work." If you have questions about the meaning of these terms, please ask. We expect you to hold to this standard by carefully citing sources used in your work and by doing your own work on tests and individual assignments.

In an environment where group work is highly valued it can be difficult to sort out which policies apply. At a minimum follow these guidelines:

- Work identified as individual should be strictly your own.
- Cheating on exams or presenting another's work as your own (plagiarism) will result in a zero grade for the assignment.
- Students are expected to actively collaborate on assignments identified as group, but it is important that only students who actively participate are given credit. The group is responsible for ensuring that all members take part and assume responsibility for group assignments.
- Material that is drawn from written or electronic sources must be appropriately cited. For on-line discussion it is usually enough to simply reference a text page or web site.

### **Grading System:**

Graded assignments include both at-home and in class activities. The grade is computed as follows: 1) *Individual homework quizzes (5%), 2) Active participation (5%), 2) in class activities (25%), and 3) labs (25%)*. Adding up these assignments yields 60% of your final grade. The remaining 40% is provided by three mandatory exams. **If you miss 5 activities or 5 labs, you will get a zero in that category (and likely fail the class).** There is extra credit in some of the class activities and in all exams. During the semester, no more than 3 missed activities or labs can be made up out of class. *Partial credit* can be earned for late work (not for the quizzes): *up to 80% within one week, 0% after one week*. Late arrivals, texting, use of computers unrelated to class activities will result in systematic point deduction.

Type of Assignment	Percentage of grade	Method of calculating
Homework individual quizzes	5%	<b><i>Due each Sunday at 11:59 pm No temporal extensions.</i></b>
Active Participation	5%	<b><i>Points deducted for lack of participation, texting, being late.</i></b>
In-class activities	25%	<b><i>Submission in class on Tuesday. Full credit for honest participation and demonstrating comprehension</i></b>
Labs	25%	<b><i>Submission in class on Thursday.</i></b>
Exams 1, 2, 3	40%	<b><i>In the COS testing center</i></b>

### **Grading-Percentage based on calculations in table above:**

A = 93-100  
A- = 90-93  
B+ = 87-90  
B = 83-87  
B- = 80-83

C+ = 77-80  
C = 73-77  
C- = 70-73  
D = 60-70  
F = 0-60

## **Homework Quiz**

Each week you must complete one quiz, made of multiple choice, multiple-answer, and ranking questions, which cover the material introduced at the beginning of the week. Please, take this homework seriously, and take the quiz only after you have studied the material and without external help. Some questions in the tests are very similar to those in the homework quiz. To encourage you to study on weekly basis (which is necessary for keeping up with the class and for a deeper understanding of the subject), no temporal extensions are allowed for the quiz submission.

## **Grading rubrics**

### **Grading rubric for class activities and labs:**

<b>Results</b>	<b>Presentation</b>	<b>Points</b>
Correct	The reasoning is correct and explicitly explained	25-23
Mostly correct	The reasoning is mostly correct and explained	22-20
Significant errors	The reasoning is either not correct are or not shown	19-17
Mostly incorrect	There are substantial misconceptions	< 17

### **Grading rubric for active participation:**

<b>Participation</b>	<b>Points</b>
Being present and active; genuine participation to group work; honest feedback	4-5
Coming late and/or spending class time on unrelated activities	3
Being absent one day	2
Being absent both days	0

## **Exams**

There are three mandatory tests: two midterms and one comprehensive final. If the grade of the final test is better than one of the midterm tests, the lowest grade will be dropped and the grade of the final will be counted twice. Exams are to be done completely individually and I expect full adherence to the honor code with no collaboration, no outside notes, etc. Your responses should come exclusively from your well-prepared and thoughtful brain.

**Schedule** (subject to change)

Week	Weekly Learning Goals	Learning Support Tasks	Assessments
Aug 23	<i>Get familiar with the class.</i>	<b>Discussion:</b> personal introductions <b>Activity:</b> discussion in pairs.	<b>Activity submission</b> <b>Homework Quiz</b>
Aug 30	<i>Describe our place in the Universe</i>	<b>Discussion:</b> personal <b>Activity:</b> clarifying misconceptions. <b>Lab1:</b> solar system walk	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Sept 6	<i>Describe the main traits of science and distinguish between science from pseudoscience</i>	<b>Math skill #1:</b> Graph reading, interpretation <b>Activity + lecture tutorial</b> <b>Lab2:</b> astronomy vs. astrology	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Sept 13	<i>Explain &amp; use basic physics laws science and apply them to different contexts</i>	<b>Math skill #2:</b> Powers of 10 <b>Activity + lecture tutorial</b> <b>Lab3:</b> Planetary motion	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Sept 20	<i>Explain and distinguish light-matter interactions</i>	<b>Math skill #3:</b> Scientific notation <b>Activity + lecture tutorial</b> <b>Lab4:</b> light & matter	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Sept 26, 27	<b>EXAM 1 on Weeks 1, 2, 3, 4</b>		
Sept 27	<i>Interpret and compare phenomena in the night sky</i>	<b>Math skill #4:</b> Manipulating numbers <b>Activity + lecture tutorial</b> <b>Lab5:</b> Celestial sphere	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Oct 4	<i>Explain the main properties &amp; evaluate advantages of telescopes</i>	<b>Math skill #5:</b> Unit conversion <b>Activity + lecture tutorial</b> <b>Lab6:</b> Reflectance spectroscopy	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Oct 13	<i>Explain the theory of solar system formation</i> <b>No Tuesday class meeting</b>	<b>Math skill #6:</b> Dimensional analysis <b>Activity + lecture tutorial</b> <b>Intro to greenhouse effect</b>	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
Oct 18	<i>Discuss terrestrial atmospheres, greenhouse effect, climate change</i>	<b>Math skill #7:</b> Fractions, decimals, percentages <b>Activity + lecture tutorial</b> <b>Lab7:</b> Climate change: science vs. myth	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>

<b>Oct 24, 25</b>	<b>EXAM 2 on Weeks 5, 6, 7, 8</b>		
<b>Oct 25</b>	<i>Examine, compare and contrast the terrestrial world</i>	<b>Activity + lecture tutorial</b> <b>Lab8:</b> Exploring planetary surfaces	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
<b>Nov 1</b>	<i>Examine, compare and contrast the Jovian planets</i>	<b>Activity</b> <b>Lab9:</b> Jovian worlds	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
<b>Nov 8</b>	<i>Explain the origin and role of asteroids, comets, and dwarf planets</i>	<b>Activity</b> <b>Lab10:</b> Citizen science & solar system	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
<b>Nov 15</b>	<i>Discuss and compare extrasolar planets</i>	<b>Activity + lecture tutorial</b> <b>Lab11:</b> Extrasolar planets	<b>Activity submission</b> <b>Lab report</b> <b>Homework Quiz</b>
<b>Nov 21, 22</b>	<b>EXAM 3 final and comprehensive</b>		